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Railroad Wrecks

Paper read by D. F. Jurgensen,
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RAILROAD WRECKS.

Mr. President, Members and Guests of the Minnesota Surveyors and Engineers' Society;

I am highly honored at being privileged to meet with such a distinguished gathering here today. Your committee waited upon me about a month ago, and asked if I would prepare a paper on the subject of "Railroad Wrecks," to be read at this meeting, to which request I hesitatingly consented.

I do not know why the committee assigned this particular subject to me, unless it was prompted by the extreme concern caused to both the public and the railroad companies in our state, as well as in the neighboring states during the past two months, because of the numerous serious accidents which have occurred, and in which many lives were lost.

This subject is a serious and important one to discuss, and early relief therefrom must be secured to the public, which is demanding and is justly entitled to a safer service, and we, as engineers and builders of railroads, owe it to the community at large, to render all aid possible in working out such corrective measures as will, if not entirely, at least materially reduce the number of such accidents, and their attendant casualties.

I believe that the number of railroad accidents can be largely decreased without interfering with the present manner of conducting the service.

One would naturally gather from the great advancement made during the past twenty years in the construction of railroad track and bridge details, in the construction of locomotives and cars, and in the development of safety appliances and improved signalling, that the number of train accidents with their attendant loss of life, should, with all these modern improvements, be materially reduced; but that apparently is not the case.

To begin with, it is assumed and granted, that no railroad manager, officer or employe, deliberately, maliciously or wilfully with evil intent, conducts his enterprise, or performs his duty with a view toward the destruction or maiming of human life.

The railroad manager and officer is without doubt as properly concerned in accidents and wrecks as is the public, because the transportation company is *prima facie* responsible, and often is compelled to pay very dearly for the resulting casualties.

Wrecks are never a good advertisement for a carrier, and like any other business enterprise which is dependent upon the confidence and good will of its patrons for its continued existence and success, railroad corporations can ill afford to ignore or neglect to employ any means, device or agency that may be conducive to the safety of its patrons.

There is probably no industry in existence that is so absolutely dependent upon the human element for its safe operation, as is a railway system; for instance, machines have been invented to aid the farmer in economically performing his work, by reducing the number of hands that otherwise would be required, but the mind of man has not yet devised a machine that will dispatch and conduct trains, handle train orders, or perform such other duties as now fall to the lot of a general railroad employe.

In this connection, it can safely be said, without fear of contradiction, that in none of the ordinary walks of life are men so well compensated for the services rendered, as are, generally speaking, the employees of the American railways; their work is steady, their pay is certain, and their hours of labor and rest have been regulated by legislation, to their advantage.

To find the preventative remedy for errors in railroad operation and railroad wrecks, the seat of the trouble, or the cause, must first be ascertained, and when once found, a panacea will be devised. We may here ask, "Is the subject of railroad accidents being seriously looked into, investigated and studied with a view towards ascertaining the cause, and applying the proper remedy; if so, by whom, and with what success?"

It is true that the Interstate Commerce Commission, and many of the state commissions, are now and for some time past have been actively engaged in conducting such investigation. The federal law under which the Interstate Commerce Commission is conducting this work is entitled:

"An Act requiring common carriers engaged in interstate and foreign commerce to make a full report of all accidents to the Interstate Commerce Commission, and authorizing investigations thereof by said Commission."

Said act was approved May 6, 1910.

It provides a penalty on failure to make report *within thirty (30) days after the end of any month*. It also gives the Commission power to investigate accidents, and reads in part as follows:

"The Commission or any impartial investigator thereunto authorized by said Commission, shall have authority to investigate

such collisions, derailments or other accidents aforesaid, and for that purpose may subpoena witnesses, administer oaths, take testimony and require the production of books, papers, orders, memoranda, exhibits and other evidence, and shall be provided by said carriers with all reasonable facilities; provided, however, that when such accident is investigated by a Commission of the state in which it occurred the Interstate Commerce Commission shall, if convenient, make any investigation it may have previously determined upon at the same time and in connection with the said State Commission investigation.

"Said Commission shall, when it deems it to the public interest, make reports of such investigations, stating the cause of accident, together with such recommendations as it deems proper, such reports shall be made public in such manner as the Commission deems proper.

"That neither said report, nor any report of said investigation nor any part thereof shall be admitted as evidence, or used for that purpose, in any suit, or action for damages, growing out of any matter mentioned in said report or investigation."

But the Interstate Commerce Commission, by said act, is *not given any power or authority to enforce the carrier's compliance with any recommendatory measures intended to prevent a recurrence of any such wreck, accident or casualty, i. e., the said federal law goes no further than the mere matter of authorizing investigations, and if the public is to receive any relief from "railroad wrecks," it must seek other sources than the federal government, as the law now stands in this respect.*

The Minnesota statute, chapter 122, Laws 1905, gives more power to the State Commission. It is:

"AN ACT Requiring Railroad Companies to Report all Wrecks and Casualties Wherein Any Persons are Injured or Killed, to the Railroad and Warehouse Commission.

"Be it enacted by the Legislature of the State of Minnesota;

"Section 1. It shall be the duty of every railroad company operating a line of railroad in this state, to report all accidents, wrecks or casualties occurring in this state, to the Railroad and Warehouse Commission. This is intended to include all accidents, wrecks and casualties occurring in the operation of trains or engines on said line or lines of railway within this state, and all other accidents or casualties of whatever nature as may be required under rules adopted by the Commission. *Any reports to the Commission herein required shall not be for public inspection.* All accidents

or wrecks occurring in the operation of trains or engines, involving loss of life or personal injury, shall be immediately reported to the Commission by telegraph or telephone message, and the company shall forthwith send a written report in detail, giving full particulars available in such form as the Commission may require. All other accidents, including accidents resulting in personal injury or death, other than train accidents, shall be reported to the Commission on the first day of each month covering the preceding month." (As amended 1907, chapter 290.)

"Sec. 2. Whenever any report is made to the Commission involving a wreck, accident or casualty, and the Commission deems it necessary, *it shall forthwith examine into the causes and circumstances of the same, and it shall thereupon be the duty of the Commission to order such railway company to comply with any reasonable requirements prescribed by the Commission calculated to prevent the recurrence of any such wreck, accident or casualty*, and it shall be the duty of the Commission to report to the legislature biennially a summarized statement of all wrecks, accidents or casualties reported, together with a recommendation of such additional legislation as it deems proper for the greater protection of passengers and employes of railroad companies." (As amended 1907, chapter 290.)

"Sec. 3. Every person who shall violate any of the provisions of this act shall be guilty of a misdemeanor and shall be punished by a fine of not less than *one hundred (\$100) dollars*, nor more than *one thousand (\$1,000) dollars*, or imprisonment in the county jail for not less than *thirty (30) days* nor more than *one year*, or shall suffer both such fine and imprisonment, in the discretion of the court.

"Sec. 4. This act shall take effect and be in force from and after its passage."

(Approved April 7, 1905.)

You will observe that the law is very broad, in that it gives the Commission ample power to go as far as is necessary to obtain results in its investigations. Not only that, the Commission is also given power to order in and to compel the carrier to comply with any reasonable requirements that may be prescribed and calculated to prevent the recurrence of such a wreck, accident or casualty. It is to be noted in this particular that the Minnesota state law goes a step further than the federal act.

Since the passage of this act, the Minnesota Commission has unceasingly prosecuted its investigations and orders embodying cor-

rective measures, and has gathered many facts which are going to be a valuable aid in the final solution of the *wreck problem*. For a practical demonstration let us see the accidents that occurred in Minnesota during the year 1911, and carry them through the different stages of classification to a point where conclusions may be arrived at.

BROKEN RAILS.

But before proceeding, I desire at this time to say just a few words on the subject of "*Broken Rails*."

The public has of late, through the press, and other sources, been impressed with the idea that "*rail failures*" are one of the *main* agents of railroad disasters. I do not want to be understood here as championing the cause of the steel trust, but in the spirit of honesty and fairness, I believe that the minds of the public should be relieved of that erroneous impression, because in my judgment the claim is not borne out by the facts, and for that reason should not, in justice to all concerned, be allowed to stand unchallenged.

As in the case of the railroad manager, officer and employe, let us be fair in our dealings with the rail manufacturer, and not charge him with having evil designs on the lives of the people who are obliged to patronize the carriers, by knowingly and wittingly manufacturing *rotten rails*.

The rail manufacturer has been, and is getting a very good price for his product, and cannot afford, for good business reasons, any more than can any other responsible manufacturer, to turn out of his mills anything but the best product. Besides this the manufacturer does not as a rule prescribe the specifications under which the rails are to be made; these requirements are being generally laid down by the carrier or the buyer, who is also privileged to, and as a rule has a representative present at the mills, whose duty it is to see to it that the rails are being made in full accordance with the contract. This inspector is given free entry to the works of the manufacturer and is afforded every reasonable facility to satisfy him that the product is turned out as called for by the specifications.

In this connection there is probably no topic associated with the subject of railroads that has been, or is at the present time being subjected to such thorough study, experiment and research as are railroad rails. Several eminent bodies composed of the ablest engineers and metallurgists in this country have been for some time past, and are still, conducting experiments and tests with a

view toward attainment of the ideal rail—and their efforts have already marked considerable progress in that direction.

The Minnesota Commission in considering this subject has recommended that there should be a system of governmental inspection of the construction of cars, rails and all structural iron or steel work used by railroads. In its opinion, the increasing number of accidents caused by broken rails and switches, and the imperfect condition of certain portions of equipment make it very apparent that the interest of both the public and the railway company will be best subserved by having such inspection.

I will endeavor to demonstrate in a practical way to what extent broken rails are the cause of railroad wrecks and in so doing will first refer to the records of the Interstate Commerce Commission, from which it is gathered that in the year ending June 30, 1911, there occurred in the entire United States 249 derailments, which were attributed to *broken rails*, and which accidents resulted in the *death of twelve persons, which is less than the average number of trespassers killed on the railways of the United States every day in the year.*

The Minnesota Railroad and Warehouse Commission, some two years ago, interested itself in instituting a systematic inquiry into the matter of *broken rails*, and to this end required *all* the principal railway companies operating in the state *to report monthly on forms furnished by the Commission, the broken rails occurring on its lines.*

Broken rails directly responsible for wrecks have been brought to the office of the Commission, where chemical analyses and tests were made of the same. The Commission is still prosecuting these examinations, with the result that a large amount of valuable data is being gathered which it is hoped will be of estimable help in the final solution of the rail question.

To give an idea of the scope of the Commission's investigation, I will quote briefly from the forms used:

"For the purpose of this report, a rail should be considered broken when complete fracture into two or more parts has taken place, or when there is any break in the head of the rail on gauge side, or when there is any break necessitating either immediate removal of rail from track or its reinforcement. In cases where broken rails have been the direct cause of accidents *a special report on Form 55 shall immediately be forwarded to this office*, this in addition to the regular monthly report covering same rail."

It is important to know if any useful conclusions can be drawn

44812 from these reports. Let us, for illustration, take the report of Minnesota for the year ending Oct. 31, 1911, and I believe the situation in this state is typical of all the northern states. This particular year is being used because the data has not been compiled for the calendar year of 1911. It is found that on the principal railroads in Minnesota during the year ending Oct. 31, 1911, there were ~~3,951~~ broken rails reported. The months of December, January and February are credited with 2,772 breakages, or ~~70~~ ^{57.3%} per cent of the total for the year. The month of January showed the largest number, viz., 1,645; the month of June had the smallest number, viz., 52. The bulk of the breakages were of the 85 and 90-pound sections, including the 90-pound Titanium, and most were rolled of a late date.

Without going into an exhaustive and detailed analysis of the state's investigations, the following inferences may be drawn from its examinations in this connection:

None of the carriers have reported, nor do they claim, that rails have broken, or are breaking, from their own inherent shortcomings, nor does it appear plausible or believable that rails that have safely stood shipment from the mills, handling and placing into track should fail from their own innate weakness.

The examinations appear to disclose that breakages occur in rails constituted of what may be classed both good and poor quality metal. The failures are undoubtedly largely caused by unusual strains which are induced by severe and abnormal service conditions to which rails are subjected, in which may be included shocks from broken or flat wheels, defective counterbalance, wheels out of round, defective track, improper fastening of rails upon ties, and other like circumstances, which would tend to produce such strains. The investigations disclose that approximately 55 per cent of the rails broken may be classified as being of good metal, the remaining 45 per cent of the failures consisting of rails that are of a poor quality metal.

By the term "poor quality metal" is meant rails proving themselves defective after having been subjected to service, and cover such defects as the examination indicates as segregation of constituents, unsoundness, brittleness, faulty rolling, including pipe, old seam, flow of metal, split head, crushed head, split web, broken base, and other shortcomings, many of which defects it would be impossible to discover at the mill.

It also appears from a careful analysis of this subject recently made by government experts that transverse fissures develop in the

rail section after a rail has been laid and subjected to service, a defect of a most dangerous character, because it cannot be detected except by chance. This defect is said to be caused by heavy wheel pressures, which induce internal strain in the steel, which reaches its greatest intensity on the gauge side of the head of the rail, where a flow of steel takes place in a lateral direction.

They also find that no foreign substance in the steel is needed to account for the presence of these fissures, and that they invariably occur on the gauge side of the rail, and from these and other facts set forth, it seems that these fissures are not defects of mill practice, and do not exist in a new rail before it is laid.

I desire at this point to quote briefly from the Interstate Commerce Commission's report of the accident on the line of the Lehigh Valley road, near Manchester, New York, Aug. 25, 1911, which accident was caused by a broken rail, and which was a 90-lb. open hearth rail.

"With the information at present available, it is extremely difficult to suggest any preventative of future accidents of this character. From such information as is at hand, however, it seems apparent that the remedy lies in the diminishing of the wheel pressure and the lowering of direct compressive and bending stresses. The report of our expert clearly shows that exhaustive experiments and tests should be begun, and that a most complete and searching examination should be made of the whole question.

These examinations should deal with steel rails from the furnace, and the time they are laid in the track; it should determine whether the tests now used in the steel mills are adequate to detect imperfect rails, it should ascertain whether the use of high carbon steel is not attended with dangers not recognized in the drawing up of current specifications; it should be extensive enough to inquire into the causes which contribute towards such a destruction of the structural integrity of the steel as was the case with this rail; it should take up the securing of measurements in the track of the actual fiber stresses which are caused by the new types and weights of locomotives, and under different wheels of these locomotives, in order to obtain information from which to judge of the severity of the strains to which the track is daily subjected; in fact, track conditions as they exist at the present time should be dealt with even to the most minute detail. It also appears that the danger zone in the use of steel rails as at present manufactured has been reached, and, since it is supposed that transverse fissures are the direct result of high wheel pressure acting on hard steel, a com-

plete investigation should be made for the purpose of scientifically determining the matter and ascertaining a remedy. Until such investigation has been made, danger of similar accidents will exist.

Out of the ~~entire~~^{less than} year's breakages in Minnesota, viz., 3,951⁴⁸¹², only four (4) or one-tenth (1-10th) of one per cent (1%) of the breakages caused derailments, as follows:

a. 80-lb. A. S. C. E. section, derailed (6) freight cars; no casualties resulted. Rail was laid in 1908 on a sharp curve, and had a badly worn ball.

b. 80-lb. A. S. C. E. section, derailed three (3) loaded freight cars, no casualties resulted. Rail was laid in 1908 on straight track and was very badly worn.

c. 68-lb. Special section (of railway company) derailed several freight cars; no casualties resulted. Rail was laid in 1891, and was much worn.

d. 56-lb., section not given, derailed one engine and two (2) coaches of passenger train; no casualties resulted. Rail was laid in 1882, and was much worn.

When it is considered that the four breakages just described were of rails badly worn, one having been in service for twenty-nine years, another for twenty years, it is not at all remarkable that the same should have been broken. It is also to be noted that the four resulting derailments were not the instrument of a single casualty.

From an examination of the *rail failures* in this state, it is to be observed that *broken rails* are not the cause of railroad casualties to the extent that the public has been led to believe.

It is also found from a study of this question that, as a rule, the train responsible for breaking the rail is not always derailed, but that the derailment generally falls to the lot of some following train. This peculiarity may be explained by the fact that a rail is not always broken clear through at first. It may be broken, say through the ball or base, and on account of the continual hammering of passing wheels, the break is finally carried through the entire section. That there are no more casualties due to broken rails may be explained by the vigilance in policing the track by the track forces of the carriers; the electric track circuit in connection with automatic block signals has also proved itself a valuable broken rail detector.

As the largest number of "*broken rails*" occur during the three winter months, and especially during the periods of extremely cold weather, it appears that railroad travel would be rendered safer

if the speed of the heavy passenger trains were restricted within moderate limits during at least the era of extreme temperatures.

On the railroads in Minnesota, during the calendar year closed, Dec. 31, 1911, 154 accidents occurred, which may properly be termed "*railroad wrecks*." These are divided into two classes, viz., *casualty and non-casualty wrecks*. Of the former, there were 53, and of the latter 101, which division assigns practically 66 per cent to the non-casualty and 34 per cent to the casualty class. A table is here prepared listing the above described wrecks properly classified under the various causes, and from which is found that:

RAILROAD WRECKS IN MINNESOTA—YEAR OF 1911

Cause	Non-Casualty		Casualty		Total Wrecks	Casualties					
	Frt. Trains	Pass. Trains	Frt. Trains	Pass. Trains		Employes		Passengers		Total	
	Inj.	Killed	Inj.	Killed		Inj.	Killed	Inj.	Killed	Inj.	Killed
Broken rails....	7	.....	1	1	9	1	.....	20	.....	21	.....
Broken switch points....	4	.....	1	.....	5	1	.....	.....	.....	1	.....
Collisions....	12	1	18	7	38	113	8	60	8	173	16
Defective track	24	.....	2	.....	26	2	.....	.....	.....	2	.....
Failure of equipment....	37	3	12	5	57	25	4	22	.....	47	4
Failure to observe signal....	5	1	1	2	9	3	2	6	.....	9	2
Open switch....	4	2	.....	1	7	1	.....	.....	.....	1	.....
Sun kink....	1	.....	.....	.....	1	.....	.....	.....	.....	.....	.....
Track tampered with....	.....	.....	.....	1	1	2	.....	.....	.....	2	.....
Wash-outs....	.....	.....	.....	1	1	4	4	11	1	15	5
Totals....	94	7	35	18	154	152	18	119	9	271	27

The above accidents, for purposes of exemplification, are then re-classified into "*Preventable*" and "*Non-Preventable Wrecks*." "*Preventable Wrecks*" are those caused by *collisions*, *defective track*, *failure to observe signal*, *open switches* and *washouts*, and which are directly chargeable to *human fallibility* and *false economy* on the part of the company. Under "*Non-Preventable Wrecks*" are included those caused by *broken rails*, *broken switch points*, *failure of equipment*, *sun kinks* and *track tampered with*, the responsibility for which cannot be directly placed. The two final divisions just described, when properly arranged into convenient tabulated form, disclose the following results:

RAILROAD WRECKS IN MINNESOTA—YEAR OF 1911

CLASS	Number	Casualties	
		No. Injured	No. Killed
Preventable.....	81	200	23
Non-preventable.....	73	71	4
Totals.....	154	271	27

It follows after the year's data is boiled down into concrete from that the preventable wrecks have resulted the most disastrously to life and limb, also that of all of the five causes incorporated under said division, *collisions* are responsible for by far the greatest number of the killed and injured, i. e., while *preventable wrecks* produced two hundred (200) injuries and twenty-three (23) deaths, collisions were the source of one hundred seventy-three (173) of the injuries, and sixteen (16) of the deaths, which leaves collisions alone accountable for about *eighty-five per cent* (85%) of all the casualties resulting from preventable wrecks.

Considerable progress has been made in late years by the development of the "*Manual and Automatic Block Signal Systems*," as measures tending toward preventing collisions. The ideal apparently has not yet been realized thereby, consequently we are led to believe that our investigations in this connection might properly be directed to the question of the possibility of obtaining the advantages assured us by the incorporation of the very best safety systems.

In our discussion toward removing the source of this most disgraceful feature of "*American railroad practice*" we should exclude matters not pertinent to the question, such as comparison of the wreck-resisting qualities of *steel* and *wooden* cars, and the policy frequently indulged in by some of the carriers in going to the extreme with record-breaking runs in an effort to outdo their competitors in an attempt to obtain what appears to them to be certain lucrative business.

While the exceptions just cited are far removed from the issue, they may be profitably discussed in their proper place; these discussions, however, will not be of any help in checkmating collisions, and no block system is of any use, or value, unless it furnishes ample protection for all trains at whatever speed they may be run.

Of all the classes of railroad wrecks, collisions appear to be

the least excusable of any. From a study of the rules, regulations and other safeguards thrown around the operation of trains by the carriers, one would wonder how it were possible for a collision ever to occur, if strict compliance with rules be rigidly observed, but as previously explained, they do occur, and that with altogether too great regularity, and are the direct source of most of the casualties associated with railroad accidents.

You ask why should this be so? What is the use of drawing up and adopting rules for the purpose of protecting life, and then not complying with them? What is the occasion for this *non-observance* of rules? The answer is *human fallibility*, and three primary reasons may be given for this ethical weakness, viz., disobedience, negligence and carelessness. Having found the fundamental causes of *preventable wrecks*, what is to be done to remove them? The answer is *apply disciplinary measures*. I desire at this point to quote Mr. Howard Elliott, president of the Northern Pacific Railway Company, in an address before the Minneapolis Publicity Club a few weeks ago, in which he said in part:

"We hear much about quasi-public corporations, and public opinion has gone a long way in taking away from the owner of public service corporations the right to manage his own property, to name his own rates or prices, to decide about his methods, and has imposed on him the responsibility of providing safe and adequate public service from his private means, but so far has exerted little influence on the men who have to make quasi-public corporations of use to the public. If a man decides to work for a quasi-public corporation, he becomes a quasi-public servant, and he has a moral duty and responsibility to society, just as much as the owner has, to see that society is not deprived of the service necessary for its existence.

"The railroad manager is hampered in obtaining absolute precision and reliability. Over many of the employes his authority is divided with the labor unions, which exercise a powerful influence in determining the extent of the authority he is to exercise over their members."

If the conditions claimed by Mr. Elliott obtain to such an extent as to hamper the management of the company in controlling its employes, it is obvious that efficient regulation and supervision by the state can only be secured by going beyond the corporate entity and its executive officers, and making each individual employe strictly and personally responsible for the proper and safe performance of his individual duties.

There is a marked contrast in sensibility to duty and responsibility to society, between the railway employees of this country and those of European railways. It might be interesting to know that there are less fatalities in connection with the operation of railways in Germany, than with the agricultural pursuits of that country.

Whenever a railroad wreck entailing loss of life occurs in that country, all the trainmen and any others who are in any way associated therewith, are immediately arrested and held by the state until such a time as they may have exonerated themselves of any blame in connection with the accident, or if found guilty they are punished accordingly by the state. This manner of dealing with the wreck situation undoubtedly has placed Germany, and other European countries in the enviable position of having attained the ideal in safe railroad operation.

I firmly believe that when the railroad employes in our country have been made strictly amenable to the state for faithful attendance to and performance of their duties that an important step will have been taken forward making railroad travel reasonably safe and free from preventable wrecks.



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